CLAIMS

1. An optical transmission system for optically transmitting at least one data signal, comprising

pulse train generating means for converting each of the at least one data signal respectively to a pulse train, based on at least one encoding pattern that is uniquely predetermined corresponding to the at least one data signal, and outputting the pulse train;

optical modulating means for converting the at least one pulse train output from the pulse train generating means to an optically modulated signal and outputting the signal;

an optical transmission path for transmitting the optically modulated signal that is output from the optical modulating means;

optical detecting means for converting the optically modulated signal transmitted on the optical transmission path to an electrical signal and outputting the signal; and

data signal extracting means for obtaining the pulse train from the electrical signal that is output from the optical detecting means based on a decoding pattern that uniquely corresponds to the encoding pattern and extracting the data signal.

2. The optical transmission system according to claim 1, wherein the pulse train generating means converts one data signal to a pulse train.

3. The optical transmission system according to claim 2, wherein the pulse train generating means comprises a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train,

the optical modulating means comprises an optical modulating portion for converting the pulse train output from the pulse train generating portion to an optically intensity modulated signal and outputting the signal,

the optical detecting means comprises an optical detecting portion for reconverting the optically intensity modulated signal transmitted on the optical transmission path to an electrical signal and outputting the signal, and

the data signal extracting means comprises a demodulating portion for extracting the pulse train from the electrical signal that is output from the optical detecting portion based on a decoding pattern that uniquely corresponds to the encoding pattern and demodulating the data signal.

4. The optical transmission system according to claim 2, wherein the pulse train generating means comprises a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train,

the optical modulating means comprises an optical modulating portion for converting the pulse train output from the pulse train generating portion to an optically intensity modulated signal and outputting the signal,

the optical detecting means comprises an optical detecting portion for reconverting the optically intensity modulated signal transmitted on the optical transmission path to an electrical signal and outputting the signal, and

the data signal extracting means comprises:

a radiating portion for radiating the electrical signal that is output from the detecting portion as a wireless signal, and

a wireless terminal for extracting the pulse train from the wireless signal radiated from the radiating portion based on a decoding pattern that uniquely corresponds to the encoding pattern and demodulating the data signal.

5. The optical transmission system according to claim 2,

wherein the pulse train generating means comprises a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train, and

the optical modulating means comprises an optical modulating portion for converting the pulse train output from the pulse train generating portion to an optically intensity modulated signal and

outputting the signal,

the optical transmission system further comprises a pulse compressing portion for receiving the optically intensity modulated signal transmitted in the transmission path, compressing a pulse width of a pulse train, which is modulation information, or reducing a rising time and/or a falling time of the pulse train, and outputting a result,

wherein the optical detecting means comprises:

an optical detecting portion for converting an optical signal output from the pulse compressing portion to an electrical signal and outputting the signal.

6. The optical transmission system according to claim 2,

wherein the pulse train generating means comprises:

a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train, and

a filter portion for increasing a pulse width of the pulse train output from the pulse train generating portion, or increasing a rising time and a falling time of the pulse train, and outputting a result,

the optical modulating means comprises an optical modulating portion for converting the pulse train output from the filter portion to an optically intensity modulated signal and outputting the signal,

the optical transmission system further comprises a pulse compressing portion for receiving the optically intensity modulated signal transmitted in the transmission path, compressing a pulse width of a pulse train, which is modulation information, or reducing a rising time and/or a falling time of the pulse train, and outputting a result,

wherein the optical detecting means comprises:

an optical detecting portion for converting an optical signal output from the pulse compressing portion to an electrical signal and outputting the signal.

7. The optical transmission system according to claim 2,

wherein the pulse train generating means comprises a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train, and

the optical modulating means comprises an optical angle modulating portion for converting the pulse train output from the pulse train generating portion to an optically angle modulated signal and outputting the signal,

the optical detecting means comprises:

an optical interference portion for receiving an optically angle modulated signal transmitted on the optical transmission path and detecting correlation between adjacent bits of a pulse train, which is modulation information, so as to output

two optical differential signals that have opposite polarities to each other and correspond to differential components of the pulse train, and

an optical detecting portion for converting one of the optical differential signals that are output from the optical interference portion to an electrical signal and outputting the signal.

8. The optical transmission system according to claim 7, wherein the optical interference portion comprises:

an optical splitting portion for splitting the input optically angle modulated signal into two,

an optical delay portion for supplying a predetermined optical delay amount to one or both of the optically angle modulated signals that are split and output from the optical splitting portion and outputting a result, and

an optical combining/splitting portion for combining the other optically angle modulated signal that is split and output from the optical splitting portion and an optically angle modulated signal that is output from the optical delay portion and splitting a result into two again so as to output optical differential signals having opposite polarities to each other.

9. The optical transmission system according to claim 8, wherein the predetermined optical delay amount is smaller

than one bit width of the pulse train.

10. The optical transmission system according to claim 2, wherein the pulse train generating means comprises a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train, and

the optical modulating means comprises an optical angle modulating portion for converting the pulse train output from the pulse train generating portion to an optically angle modulated signal and outputting the signal,

the optical detecting means comprises:

an optical interference portion for receiving an optically angle modulated signal transmitted on the optical transmission path and detecting correlation between adjacent bits of a pulse train, which is modulation information, so as to output two optical differential signals that have opposite polarities to each other and correspond to differential components of the pulse train, and

an optical balance detecting portion for reconverting the two optical differential signals that are output from the optical interference portion to respective electrical signals and for combining the two signals so as to generate and output a bipolar differential pulse train.

11. The optical transmission system according to claim 10, wherein the optical interference portion comprises:

an optical splitting portion for splitting the input optically angle modulated signal into two,

an optical delay portion for supplying a predetermined optical delay amount to one or both of the optically angle modulated signals that are split and output from the optical splitting portion and outputting a result, and

an optical combining/splitting portion for combining the other optically angle modulated signal that is split and output from the optical splitting portion and an optically angle modulated signal that is output from the optical delay portion and splitting a result into two again so as to output optical differential signals having opposite polarities to each other.

12. The optical transmission system according to claim 11, wherein the predetermined optical delay amount is smaller than one bit width of the pulse train.

13. The optical transmission system according to claim 10, wherein the optical balance detecting portion comprises:

a first optical detecting portion for reconverting one of the optical differential signals that are output from the optical interference portion to a first differential pulse train, which is an electrical signal, and outputting the signal;

a second optical detecting portion for reconverting the other optical differential signal that is output from the optical interference portion to a second differential pulse train, which is an electrical signal, and outputting the signal;

a delay portion for supplying a predetermined electrical delay amount to the first differential pulse train output from the first optical detecting portion and/or the second differential pulse train output from the second optical detecting portion and outputting a result; and

a combining portion for combining the first differential pulse train and the second differential pulse train that have been subjected to the delay processing in the delay portion to output a bipolar differential pulse train.

14. The optical transmission system according to claim 10, wherein the optical interference portion comprises:

an optical splitting portion for splitting the input optically angle modulated signal into two,

an optical delay portion for supplying a predetermined optical delay amount to one or both of the optically angle modulated signals that are split and output from the optical splitting portion and outputting a result, and

an optical combining/splitting portion for combining the other optically angle modulated signal that is split and output from the optical splitting portion and an optically angle modulated

signal that is output from the optical delay portion and splitting a result into two again so as to output optical differential signals having opposite polarities to each other,

wherein the optical balance detecting portion comprises:

a first optical detecting portion for reconverting one of the optical differential signals that are output from the optical interference portion to a first differential pulse train, which is an electrical signal, and outputting the signal;

a second optical detecting portion for reconverting the other optical differential signal that is output from the optical interference portion to a second differential pulse train, which is an electrical signal, and outputting the signal;

a delay portion for supplying a predetermined electrical delay amount to the first differential pulse train output from the first optical detecting portion and/or the second differential pulse train output from the second optical detecting portion and outputting a result; and

a combining portion for combining the first differential pulse train and the second differential pulse train that have been subjected to the delay processing in the delay portion to output a bipolar differential pulse train.

15. The optical transmission system according to claim 14, wherein the predetermined electrical delay amount is equal to the predetermined optical delay amount.

16. The optical transmission system according to claim 2,

wherein the pulse train generating means comprises a pulse train generating portion for converting an input data signal to a pulse train based on a predetermined encoding pattern, and outputting the pulse train, and

the optical modulating means comprises an optical modulating portion for converting the pulse train output from the pulse train generating portion to an optically intensity modulated signal and outputting the signal,

the optical transmission system further comprises a wavelength dispersing portion that has wavelength dispersion characteristics and receives the optically intensity modulated signal transmitted on the optical transmission path, compresses a pulse width of a pulse train or a synthesized signal, which is modulation information, or reduces a rising time and/or a falling time of the pulse train, and outputting a result,

wherein the optical detecting means comprises:

an optical detecting portion for converting an optical signal output from the wavelength dispersing portion to an electrical signal and outputting the signal.

17. The optical transmission system according to claim 16,

wherein the optical modulating portion uses a directly optical modulation scheme in which a current injected to a

semiconductor laser is modulated with an input pulse train to output an optically intensity modulated signal.

18. The optical transmission system according to claim 1, wherein the pulse train generating means converts at least 2 data signals to pulse trains.

19. The optical transmission system according to claim 18, wherein the pulse train generating means comprises a plurality of pulse train generating portions for converting a plurality of data signals to respective pulse trains that are of predetermined modulation types, based on encoding patterns each of which is predetermined corresponding to an input data signal and is different from one another, and outputting the pulse train, and

wherein the optical modulating means comprises:

a plurality of optical modulating portions that are provided corresponding to the pulse train generating portions and convert the pulse trains output from the respective pulse train generating portions to respective optically modulated signals and outputting the signals, and

an optical combining portion for combining the optically modulated signals output from the plurality of optical modulating portions and outputting a result to the optical transmission path.

20. The optical transmission system according to claim 19, wherein the optical detecting means comprises an optical detecting portion for reconverting the optically modulated signals transmitted on the optical transmission path to electrical signals and outputting the signals, and

the data signal extracting means comprises a demodulating/separating portion for extracting the pulse trains from the electrical signals that are output from the optical detecting portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulating the data signals.

21. The optical transmission system according to claim 19, wherein the optical detecting means comprises:

an optical splitting portion for splitting the optically modulated signal transmitted on the optical transmission path to a plurality of signals and outputting the signals, and

a plurality of optical detecting portions that are provided corresponding respectively to the plurality of optically modulated signals that are split and output by the optical splitting portion, and reconvert the optically modulated signals to electrical signals to output the signals, and

wherein the data signal extracting means comprises a plurality of demodulating/separating portion that are provided

corresponding respectively to the plurality of optical detecting portions and extract the pulse trains from the electrical signals that are output from the optical detecting portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulate the data signals.

22. The optical transmission system according to claim 19, further comprising a data optical modulating portion for converting a data signal having a lower rate than a repetitive cycle of pulse trains output from the plurality of pulse train generating portions to an optically modulated signal and outputting the signal,

wherein the optical synthesizing portion further synthesizes the data signal output from the data optical modulating portion, and

the data signal extracting means comprises:

a data separating portion for outputting the electrical signals output from the optical detecting portion separated into the data signal having a lower rate than the repetitive cycle of the pulse train and other signals (synthesized signal), and

a demodulating/separating portion for extracting the pulse trains from the synthesized signal output from the data separating portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulating the data signals.

23. The optical transmission system according to claim 19, further comprising a wavelength control portion for controlling such that wavelengths of optically modulated signals output from the plurality of optical modulating portions do not overlap each other.

24. The optical transmission system according to claim 18, wherein the pulse train generating means comprises a plurality of pulse train generating portions for converting a plurality of input data signals to respective pulse trains that are of predetermined modulation types, based on encoding patterns each of which is predetermined corresponding to the input data signal and different from one another, and outputting the pulse train, and

wherein the optical modulating means comprises:

a synthesizing portion for outputting an electrical signal obtained by synthesizing pulse trains output from the plurality of pulse train generating portions, and

an optical modulating portion for converting the electrical signal output from the synthesizing portion to an optically modulated signal and outputting the signal.

25. The optical transmission system according to claim 24, wherein the optical detecting means comprises an optical

detecting portion for reconverting the optically modulated signals transmitted on the optical transmission path to electrical signals and outputting the signals, and

the data signal extracting means comprises a demodulating/separating portion for extracting the pulse trains from the electrical signals that are output from the optical detecting portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulating the data signals.

26. The optical transmission system according to claim 24,

wherein the optical detecting means comprises an optical detecting portion for reconverting the optically modulated signals transmitted on the optical transmission path to electrical signals and outputting the signals, and

the data signal extracting means comprises:

a radiating portion for radiating the electrical signals output from the optical detecting portion as wireless signals; and

a plurality of wireless terminals for extracting the pulse trains from the wireless signals that are output from the radiating portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulating the data signals.

27. The optical transmission system according to claim 24, wherein the optical detecting means comprises:

an optical splitting portion for splitting the optically modulated signal transmitted on the optical transmission path to a plurality of signals and outputting the signals, and

a plurality of optical detecting portions that are provided corresponding respectively to the plurality of optically modulated signals that are split and output by the optical splitting portion, and reconvert the optically modulated signals to electrical signals and outputs the signals, and

wherein the data signal extracting means comprises a plurality of demodulating/separating portion that are provided corresponding respectively to the plurality of optical detecting portions and extract the pulse trains from the electrical signals that are output from the optical detecting portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulate the data signals.

28. The optical transmission system according to claim 24, wherein the synthesizing portion further synthesizes a data signal having a lower rate than a repetitive cycle of pulse trains output from the plurality of pulse train generating portions, wherein the optical detecting means comprises:

an optical splitting portion for splitting the optically modulated signal transmitted on the optical transmission

path to a plurality of signals and outputting the signals,

a plurality of optical detecting portions that are provided corresponding respectively to the plurality of optically modulated signals that are split and output by the optical splitting portion, and reconvert the optically modulated signals to electrical signals and outputs the signals, and

data optical detecting portion for reconverting one of the optically modulated signals that are split and output by the optical splitting portion to a data signal having a lower rate than the repetitive cycle of the pulse trains output from the plurality of pulse train generating portions and outputting the signal,

wherein the data signal extracting means comprises a plurality of demodulating/separating portions that are provided corresponding respectively to the plurality of optical detecting portions and extract the pulse trains from the electrical signals that are output from the optical detecting portion based on decoding patterns that uniquely correspond to the plurality of encoding patterns and demodulate the data signals.

29. The optical transmission system according to claim 24, further comprising a pulse compressing portion for receiving the optically intensity modulated signal transmitted in the transmission path, compressing a pulse width of a pulse train, which is modulation information, or reducing a rising time and/or

a falling time of the pulse train, and outputting a result,

wherein the optical detecting means comprises:

an optical detecting portion for converting an optical signal output from the pulse compressing portion to an electrical signal and outputting the signal.

30. The optical transmission system according to claim 24, further comprising:

a filter portion that is provided between each of the pulse train generating portions and the synthesizing portion and increases a pulse width of the pulse train output from the pulse train generating portion, or increases a rising time and a falling time of the pulse train and outputs a result, and

a pulse compressing portion for receiving the optically intensity modulated signal transmitted in the transmission path, compressing a pulse width of a pulse train, which is modulation information, or reducing a rising time and/or a falling time of the pulse train, and outputting a result,

wherein the optical detecting means comprises:

an optical detecting portion for converting an optical signal output from the pulse compressing portion to an electrical signal and outputting the signal.

31. The optical transmission system according to claim 2, wherein the optical modulating portion is an optical angle

modulating portion for converting the pulse train output from the pulse train generating portion to an optically angle modulated signal and outputting the signal, and

the optical detecting means comprises:

an optical interference portion for receiving an optically angle modulated signal transmitted on the optical transmission path and detecting correlation between adjacent bits of a pulse train, which is modulation information, so as to output two optical differential signals that have opposite polarities to each other and correspond to differential components of the pulse train, and

an optical detecting portion for converting one of the optical differential signals that are output from the optical interference portion to an electrical signal and outputting the signal.

32. The optical transmission system according to claim 32, wherein the optical interference portion comprises:

an optical splitting portion for splitting the input optically angle modulated signal into two,

an optical delay portion for supplying a predetermined optical delay amount to one or both of the optically angle modulated signals that are split and output from the optical splitting portion and outputting a result, and

an optical combining/splitting portion for combining

the other optically angle modulated signal that is split and output from the optical splitting portion and an optically angle modulated signal that is output from the optical delay portion and splitting a result into two again so as to output optical differential signals having opposite polarities to each other.

33. The optical transmission system according to claim 32, wherein the predetermined optical delay amount is smaller than one bit width of the pulse train.

34. The optical transmission system according to claim 24, wherein the optical modulating portion is an optical angle modulating portion for converting the pulse train output from the pulse train generating portion to an optically angle modulated signal and outputting the signal,

the optical detecting means comprises:

an optical interference portion for receiving an optically angle modulated signal transmitted on the optical transmission path and detecting correlation between adjacent bits of a pulse train, which is modulation information, so as to output two optical differential signals that have opposite polarities to each other and correspond to differential components of the pulse train, and

an optical balance detecting portion for reconverting the two optical differential signals that are output from the

optical interference portion to respective electrical signals and for combining the two signals so as to generate and output a bipolar differential pulse train.

35. The optical transmission system according to claim 34, wherein the optical interference portion comprises:

an optical splitting portion for splitting the input optically angle modulated signal into two,

an optical delay portion for supplying a predetermined optical delay amount to one or both of the optically angle modulated signals that are split and output from the optical splitting portion and outputting a result, and

an optical combining/splitting portion for combining the other optically angle modulated signal that is split and output from the optical splitting portion and an optically angle modulated signal that is output from the optical delay portion and splitting a result into two again so as to output optical differential signals having opposite polarities to each other.

36. The optical transmission system according to claim 35, wherein the predetermined optical delay amount is smaller than one bit width of the pulse train.

37. The optical transmission system according to claim 34, wherein the optical balance detecting portion comprises:

a first optical detecting portion for reconverting one of the optical differential signals that are output from the optical interference portion to a first differential pulse train, which is an electrical signal, and outputting the signal;

a second optical detecting portion for reconverting the other optical differential signal that is output from the optical interference portion to a second differential pulse train, which is an electrical signal, and outputting the signal;

a delay portion for supplying a predetermined electrical delay amount to the first differential pulse train output from the first optical detecting portion and/or the second differential pulse train output from the second optical detecting portion and outputting a result; and

a combining portion for combining the first differential pulse train and the second differential pulse train that have been subjected to the delay processing in the delay portion to output a bipolar differential pulse train.

38. The optical transmission system according to claim 34, wherein the optical interference portion comprises:

an optical splitting portion for splitting the input optically angle modulated signal into two,

an optical delay portion for supplying a predetermined optical delay amount to one or both of the optically angle modulated signals that are split and output from the optical splitting portion

and outputting a result, and

an optical combining/splitting portion for combining the other optically angle modulated signal that is split and output from the optical splitting portion and an optically angle modulated signal that is output from the optical delay portion and splitting a result into two again so as to output optical differential signals having opposite polarities to each other,

wherein the optical balance detecting portion comprises:

a first optical detecting portion for reconverting one of the optical differential signals that are output from the optical interference portion to a first differential pulse train, which is an electrical signal, and outputting the signal;

a second optical detecting portion for reconverting the other optical differential signal that is output from the optical interference portion to a second differential pulse train, which is an electrical signal, and outputting the signal;

a delay portion for supplying a predetermined electrical delay amount to the first differential pulse train output from the first optical detecting portion and/or the second differential pulse train output from the second optical detecting portion and outputting a result; and

a combining portion for combining the first differential pulse train and the second differential pulse train that have been subjected to the delay processing in the delay portion to output a bipolar differential pulse train.

39. The optical transmission system according to claim 38, wherein the predetermined electrical delay amount is equal to the predetermined optical delay amount.

40. The optical transmission system according to claim 24, wherein the optical modulating portion converts the pulse train output from the pulse train generating portion to an optically intensity modulated signal and outputs the signal,

the optical transmission system further comprises a wavelength dispersing portion that has wavelength dispersion characteristics and receives the optically intensity modulated signal transmitted on the optical transmission path, compresses a pulse width of a pulse train or a synthesized signal, which is modulation information, or reduces a rising time and/or a falling time of the pulse train, and outputting a result,

wherein the optical detecting means comprises:

an optical detecting portion for converting an optical signal output from the wavelength dispersing portion to an electrical signal and outputting the signal.

41. The optical transmission system according to claim 40, wherein the optical modulating portion uses a directly optical modulation scheme in which a current injected to a semiconductor laser is modulated with an input pulse train to output

an optically intensity modulated signal.

42. The optical transmission system according to claim 1, wherein a modulation type of a pulse train converted by the pulse train generating means is a pulse position modulation type.

43. The optical transmission system according to claim 1, wherein a pulse train obtained by the data signal extracting means is an UWB (Ultra Wide Band) signal.

44. A transmitter apparatus for optically transmitting at least one data signal, comprising

pulse train generating means for converting each of the at least one data signal respectively to a pulse train, based on at least one encoding pattern that is uniquely predetermined corresponding to the at least one data signal, and outputting the pulse train; and

optical modulating means for converting the at least one pulse train output from the pulse train generating means to an optically modulated signal and outputting the signal to an optical transmission path.

45. A receiver apparatus for receiving an optically modulated signal that has been modulated with a pulse train obtained by converging at least one data signal, based on at least one encoding

pattern that is uniquely predetermined corresponding to the at least one data signal, via an optical transmission path, comprising:

optical detecting means for converting the optically modulated signal transmitted on the optical transmission path to an electrical signal and outputting the signal; and

data signal extracting means for obtaining the pulse train from the electrical signal that is output from the optical detecting means based on a decoding pattern that uniquely corresponds to the encoding pattern and extracting the data signal.